# The association between spastic Cerebral Palsy, intellectual impairment and gestational age: results from the Northern Ireland Cerebral Palsy Register

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## Northern Ireland Cerebral Palsy Register (NICPR)

**NICPR commenced its work in 1992 and it is one of the longest standing registers in Europe. The aims of the NICPR are to establish a systematic approach to the surveillance of Cerebral Palsy (CP) among children in Northern Ireland, and to support research and audits into the condition.**

**The Register has surveyed children with CP for a span of almost 40 birth years (1977-2016). Information on children with CP is collected by means of a Standard Assessment form completed by clinicians. The NICPR relies on the support of over 110 clinicians.**

**More details on the NICPR can be found on our website:**

**www.qub.ac.uk/research-centres/nicpr/**

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## Introduction

Evidence suggests there is a complex relationship between Cerebral Palsy subtype, gestational age (GA), and severity of intellectual impairment. To investigate these relationships, we conducted analyses on over 1,100 children with Spastic Bilateral and Unilateral Cerebral Palsy subtypes included in the NICPR, focusing on the intellectual impairment outcome.

## Aims

- To assess the association between intellectual impairment severity and gestational age while controlling for birth weight
- To test if this association changes between the Spastic Bilateral and Unilateral Cerebral Palsy subtypes

## Methods

Population: Children registered in NICPR born between 1981-2008 with Spastic Bilateral and Unilateral Cerebral Palsy subtypes. Those with acquired Cerebral Palsy (Cerebral Palsy due to lesions or anomalies occurring after 28 days of life) and those who died before the age of 2 were excluded.

Measures : **Gestational Age** was categorised into very/ extremely preterm (<32 weeks), moderately preterm (32 to 36 weeks) and term (37+ weeks). **Birth weight** was standardised (z-scores) using Gardosi foetal growth standard curves (Gardosi et al., 1995). **Intellectual impairment** was categorised into severe (IQ <50) and not severe (IQ >=50). Surveillance of Cerebral Palsy in Europe categories for **Spastic Bilateral and Unilateral Cerebral Palsy subtypes** were used (SCPE, 2000). To control for **socio-economic deprivation** , we used the Northern Ireland Multiple Deprivation Measure (NISRA, 2005) and compared children living in areas in the most deprived quintile to children living in less deprived areas.

**Statistical analyses**

We used descriptive statistics and logistic regressions to investigate the effects of Gestational Age and Cerebral Palsy subtype on intellectual impairment, while controlling for standardised birth weight, child's sex, exposure to socio-economic deprivation, and the effects of year of birth.

## Results

**Descriptive statistics**: Information was available for 1,197 children born between 1981 and 2008 who were diagnosed with Bilateral (n = 693; 54% of all eligible) or Unilateral Spastic (n = 504; 39% of all eligible) Cerebral Palsy.

| | | Bilateral Spastic | | Unilateral Spastic | | Total | |
|---|---|---|---|---|---|---|---|
| | | *n* | *%* | *n* | *%* | *n* | *%* |
| Child's Sex | Female | 261 | 37.7 | 236 | 46.8 | 497 | 41.5 |
| | Male | 432 | 62.3 | 268 | 53.2 | 700 | 58.5 |
| Gestational Age | Very Pre-Term | 238 | 34.3 | 102 | 20.2 | 340 | 28.4 |
| | Mod. Pre-Term | 128 | 18.5 | 85 | 16.9 | 213 | 17.8 |
| | Term | 327 | 47.2 | 317 | 62.9 | 644 | 53.8 |
| Deprivation | Less deprived | 307 | 44.3 | 208 | 41.3 | 515 | 43.0 |
| | Most deprived | 386 | 55.7 | 296 | 58.7 | 682 | 57.0 |
| Cognitive Impairment | Not severe | 414 | 59.7 | 455 | 90.3 | 869 | 72.6 |
| | Severe | 279 | 40.3 | 49 | 9.7 | 328 | 27.4 |
| | | ***Mean*** | ***SD*** | ***Mean*** | ***SD*** | ***Mean*** | ***SD*** |
| Birth Weight | Std Z score | -0.41 | 2.04 | -0.31 | 1.63 | -0.37 | 1.88 |

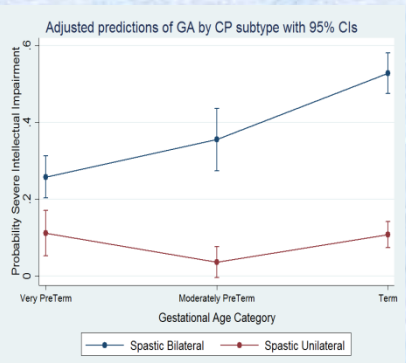
**Regression analyses:** Premature birth was associated with reduced odds of severe intellectual impairment, but this effect was conditional on CP subtype.

A quadratic association was observed between standardised birth weight and severe intellectual impairment: probability of impairment increased steeply with lower standardised birth weight.

Results confirmed a strong association between Spastic Bilateral CP subtype and severe intellectual impairment. The probability of severe intellectual impairment among these children increased across gestational age categories (see Figure).

| | | *OR* | *SE* | *z* | *95%* | *CI* |
|---|---|---|---|---|---|---|
| Gender | Female | *reference* | --- | --- | --- | --- |
| | Male | 1.11 | 0.17 | 0.69 | 0.82 | to 1.51 |
| Gestational Age | Term | *reference* | --- | --- | --- | --- |
| | Mod. Pre-Term | 0.29 | 0.18 | -1.98* | 0.09 | to 0.99 |
| | Very Pre-Term | 1.01 | 0.37 | 0.03 | 0.49 | to 2.07 |
| Birth Weight | Z score | 0.92 | 0.04 | -2.07* | 0.85 | to 1.00 |
| | Z score^2 | 1.01 | 0.01 | 2.10* | 1.00 | to 1.03 |
| CP Subtype | Spastic Unilateral | *reference* | --- | --- | --- | --- |
| | Spastic Bilateral | 10.12 | 2.27 | 10.32*** | 6.52 | to 15.70 |
| GA X CP Subtype | Term X Bilateral | *reference* | --- | --- | --- | --- |
| | MPT X Bilateral | 1.54 | 1.02 | 0.65 | 0.42 | to 5.67 |
| | VPT X Bilateral | 0.27 | 0.11 | -3.12** | 0.12 | to 0.62 |
| Multiple Deprivation | Less deprived | *reference* | --- | --- | --- | --- |
| | Most deprived | 0.92 | 0.14 | -0.55 | 0.69 | to 1.24 |
| *Constant* | | 0.08 | 0.03 | -5.66*** | 0.03 | to 0.19 |

*p < .05 ** p < .01 *** p < .001




## Discussion

The study provides further support to studies indicating that prematurity does not adversely affect the probability of intellectual impairment in children with Spastic Bilateral CP subtype (Hemmings et al, 2008).

These results may be explained by the fact that Spastic CP can be a heterogeneous group, with different aetiologies across gestational ages. However, these could also indicate that the brain may be able to compensate and reorganise following injuries during early development.

These findings need to be replicated and extended using larger datasets from international collaborations, and including more detailed information about birth.

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